But How Do You Build One?

Theo ten Brummelaar

CHARA – Georgia State University

Things to Think About

- Operating wavelength, bandwidth, site location
- Match apertures to r0
- Tip/tilt adaptive optics
- Optical path length compensation & phase stability
- Dispersion: vacuum or air?
- Metrology

More Things to Think About

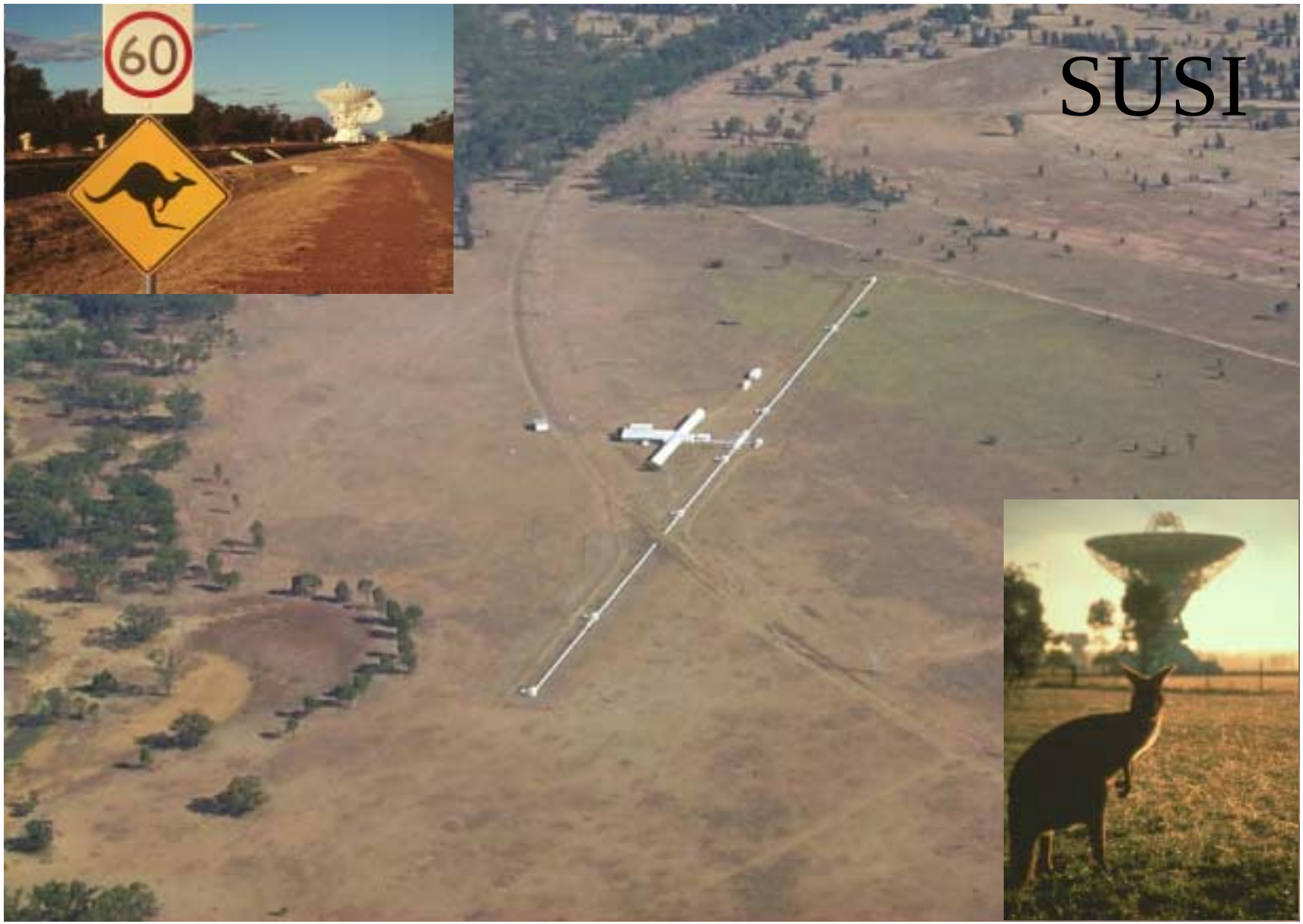
- Optics: quality & quantity
- OTF coatings
- Polarization—dynamic & geometrical phase shifts
- Diffraction
- Control & data acquisition systems

Interferometry and Stellar Interferometers

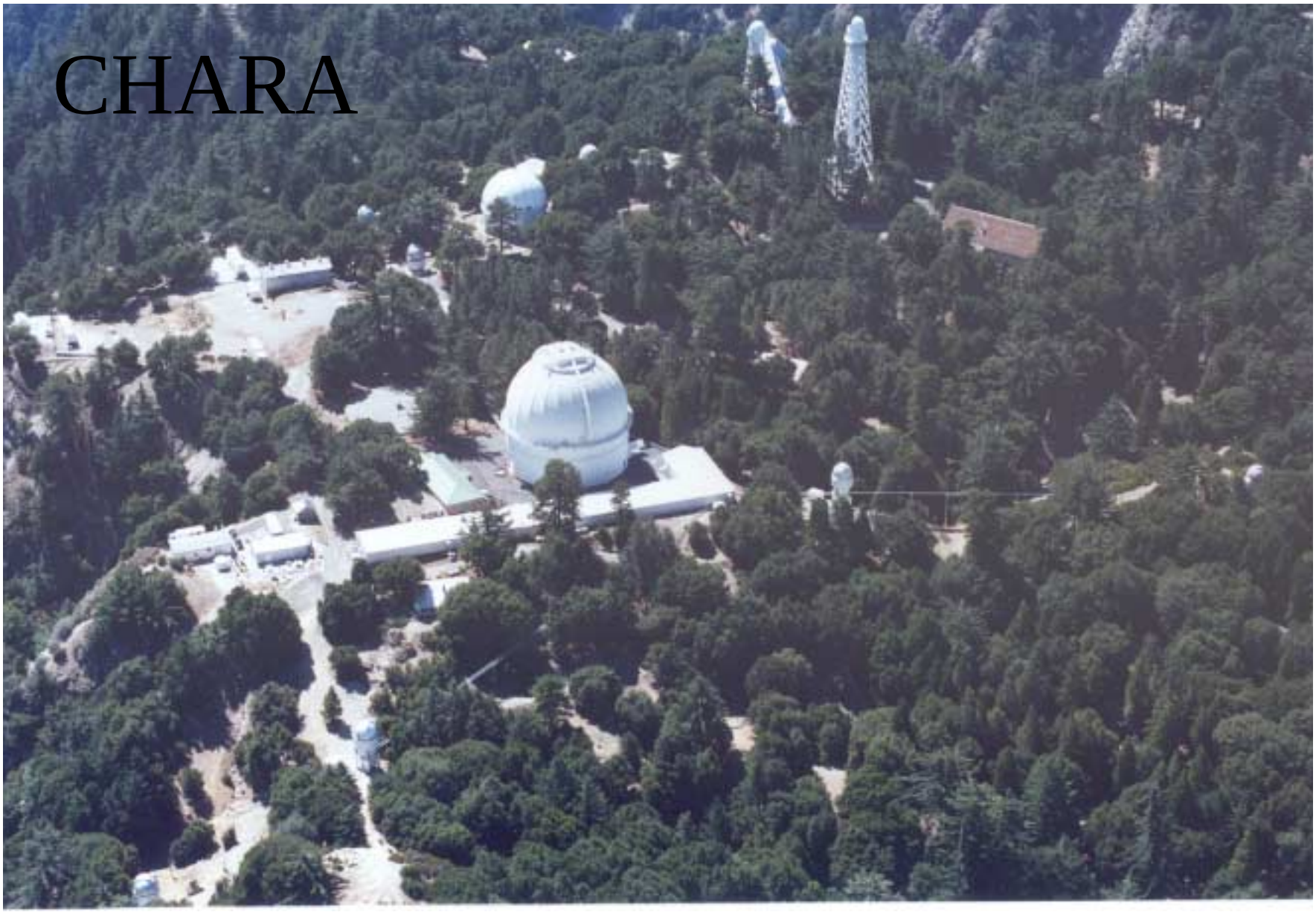
Name	Institution	Site	Number of Elements	Element Aperture (cm)	Max. Baseline (m)	Operating Wavelength (microns)	Operating Status
GI2T	CERGA	Calern	2	150	35	0.4 - 0.8 & >1.2	since 1985
COAST	Cambridge U	Cambridge	4	40	100	0.4 - 0.95 & 2.2	since 1991
SUSI	Sydney U	Narrabri	13	14	640	0.4 - 0.66	since 1991
IOTA	CfA	Mt. Hopkins	3	45	38	0.5 - 2.2	since 1993
ISI	Berkeley U	Mt. Wilson	3	165	30(+)	10	since 1990
NPOI	USNO/NRL	Anderson Mesa	6	60	435	0.45 - 0.85	since 1995
PTI	JPL/Caltech	Mt. Palomar	2	40	110	1.5 - 2.4	since 1995
CHARA	Georgia St. U	Mt. Wilson	6	100	350	0.45 - 2.4	since 1999
Keck	CARA	Mauna Kea	2(4)	1,000(180)	165	2.2 - 10	initial 2001
VLTI	ESO	Cerro Paranal	4(3)	840(250)	200	0.45-12	initial 2001
MIRA	NAOJ	Tokyo	2	13	30	??	initial 2002

Site Selection Concerns

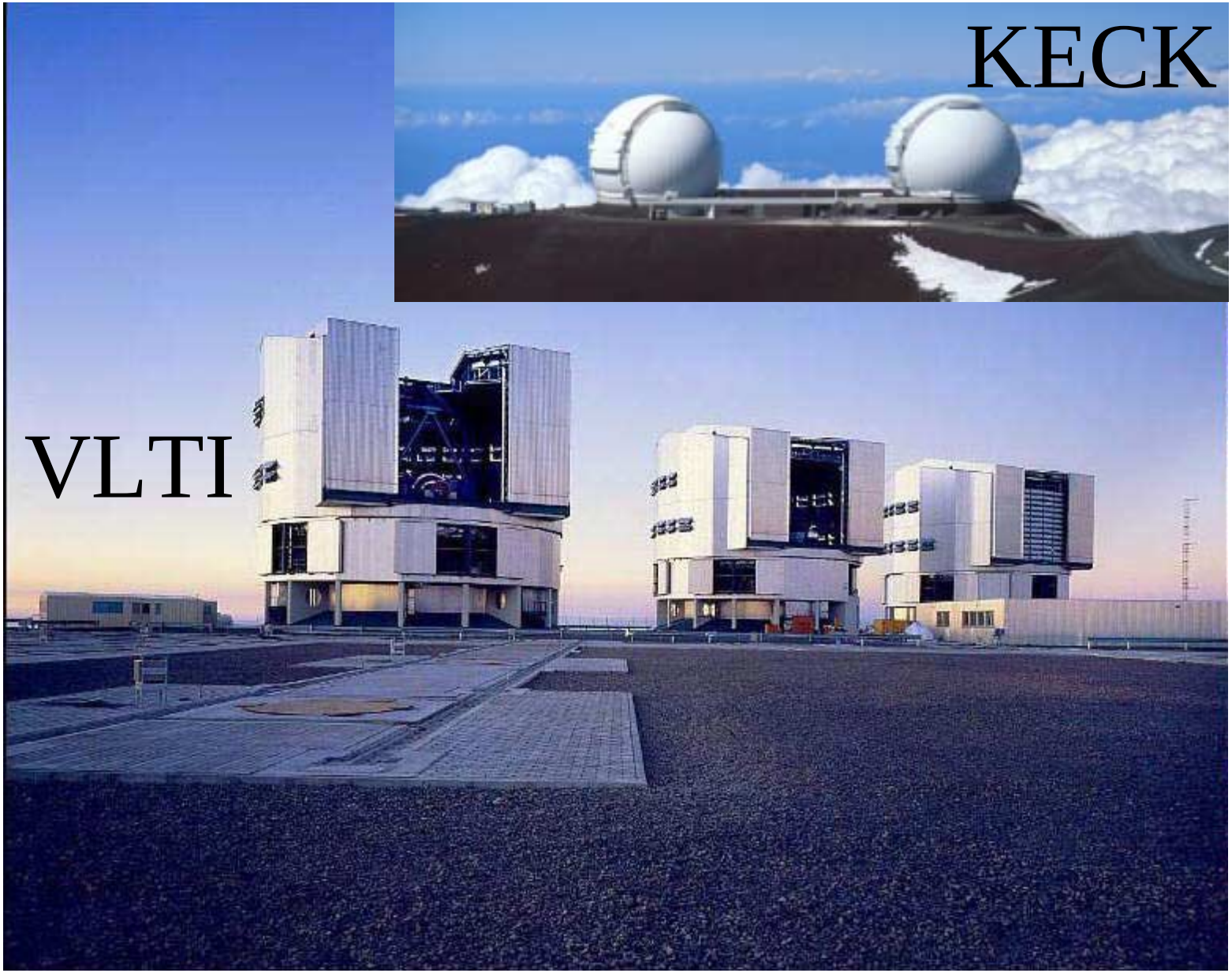
- Morphology
- The atmosphere above
- The ground below
- Vibration
- Facilities
- Location

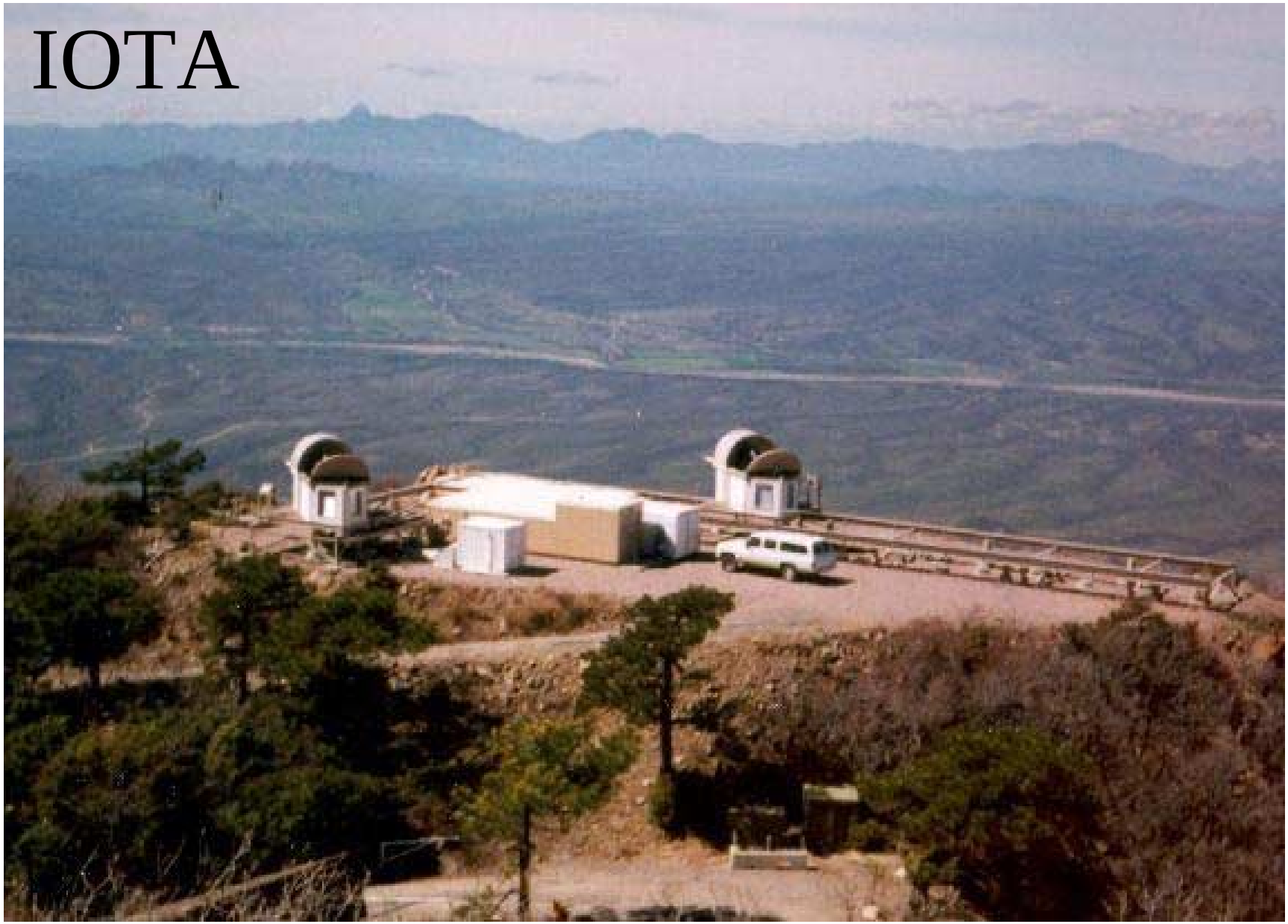

60
SUSI

Interferometry and Stellar Interferometers

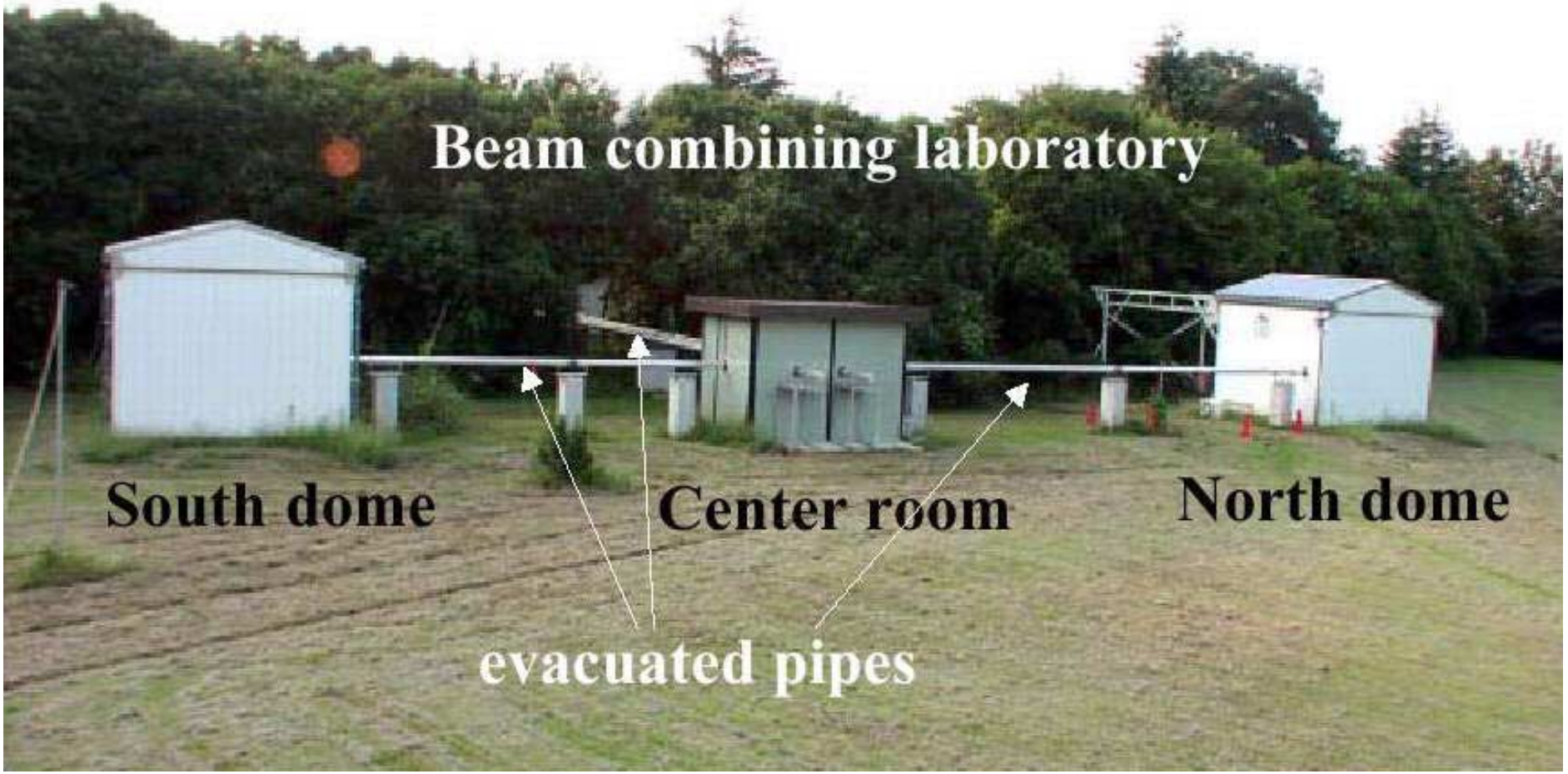

CHARA

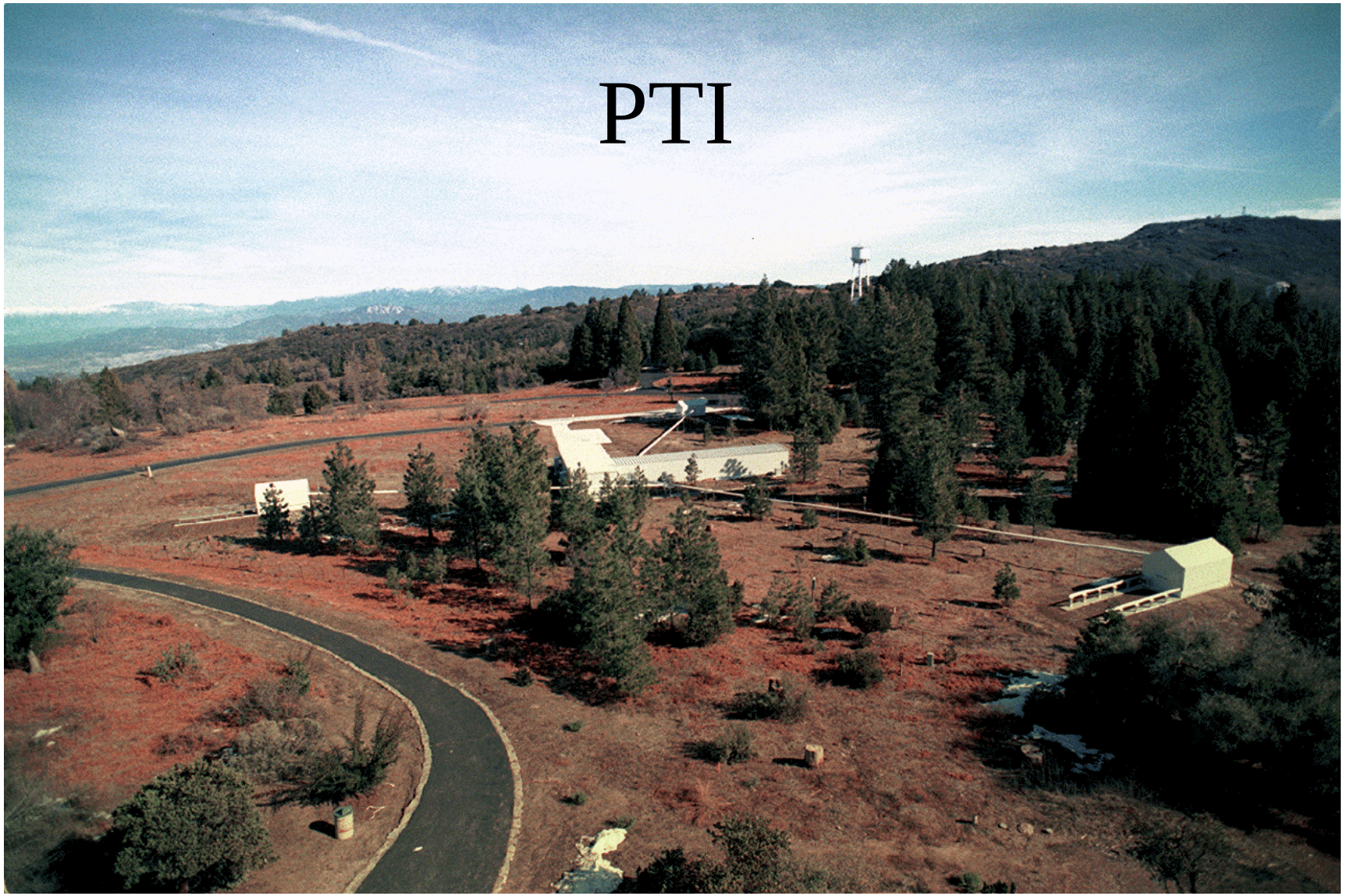
Interferometry and Stellar Interferometers




IOTA

MIRA


Beam combining laboratory
South dome
Center room
North dome
evacuated pipes


PTI

Interferometry and Stellar Interferometers

Steel and Concrete

- You need to secure things to ‘bedrock’
- Optical and building foundations must be isolated
- Everything needs to be stable at the micron level
- You need to have a contractor you can trust

Interferometry and Stellar Interferometers

Interferometry and Stellar Interferometers

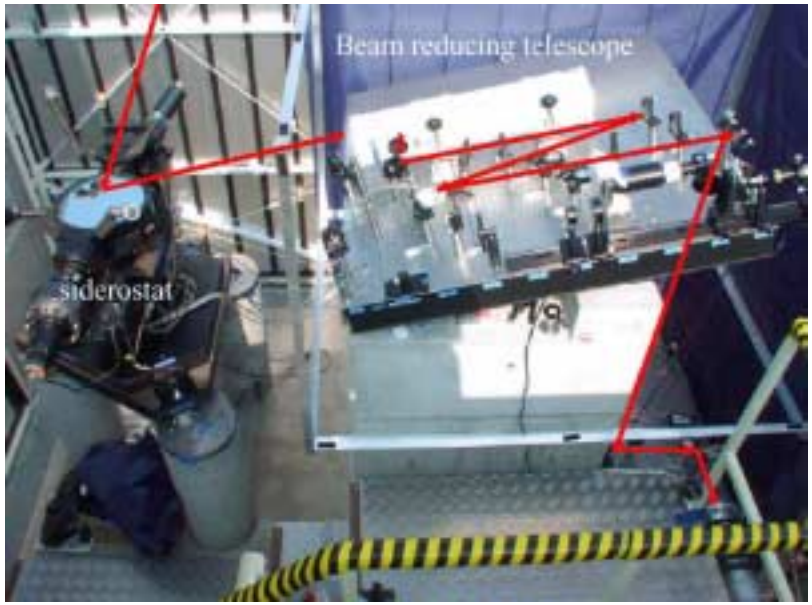
The Light Must Get In Somehow

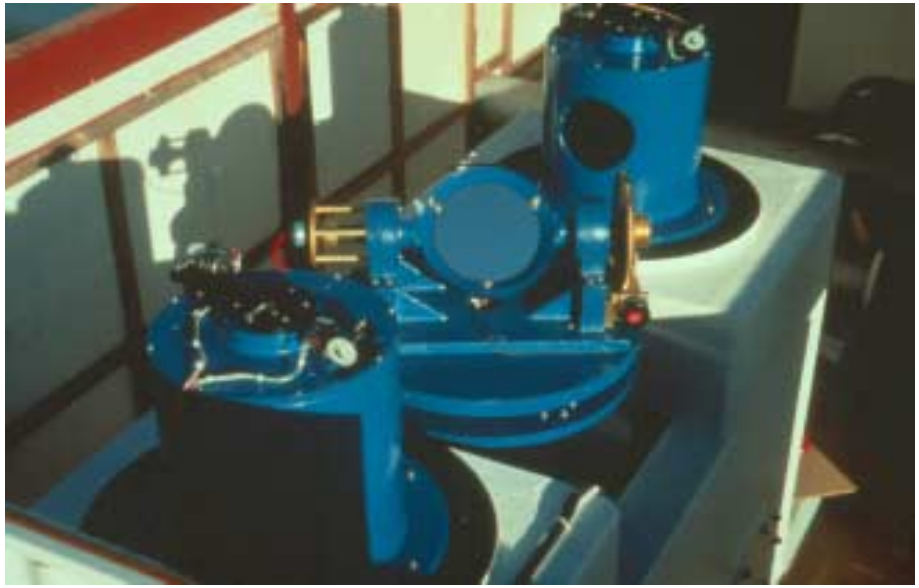
- Aperture size: seeing and adaptive optics
- Siderostat Vs Telescope
- How many apertures can you afford?
- Movable Vs Stationary

Interferometry and Stellar Interferometers

Interferometry and Stellar Interferometers

Interferometry and Stellar Interferometers





Interferometry and Stellar Interferometers

Interferometry and Stellar Interferometers

Interferometry and Stellar Interferometers

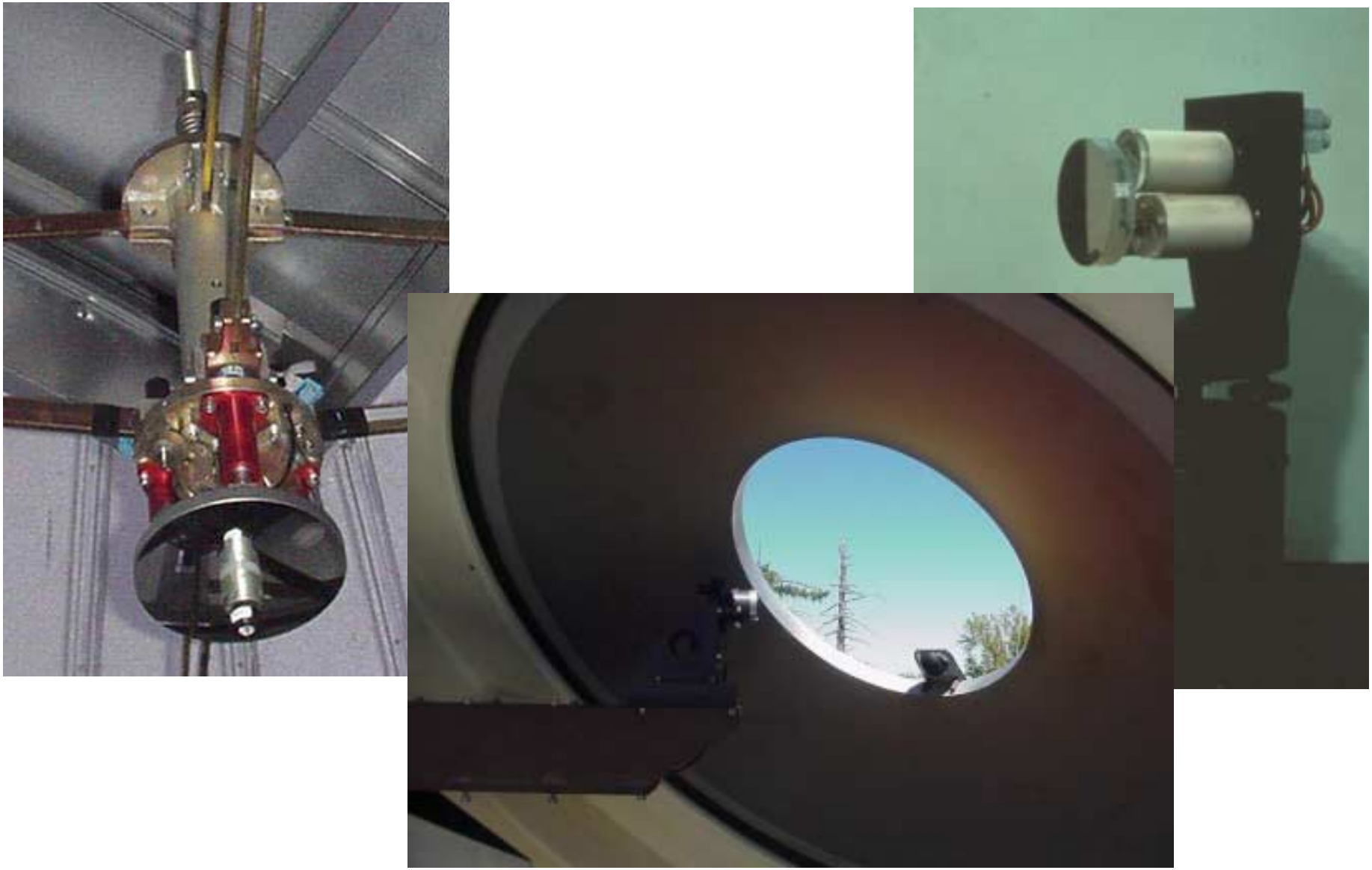
The Light Has to Reach the Center

Interferometry and Stellar Interferometers

The Light Needs to be Stable

- You must have tip/tilt
- Your beam size should be well matched to the seeing
- Adaptive optics may help
- The optical train should not introduce any more instabilities (site/mount vibration)

Interferometry and Stellar Interferometers

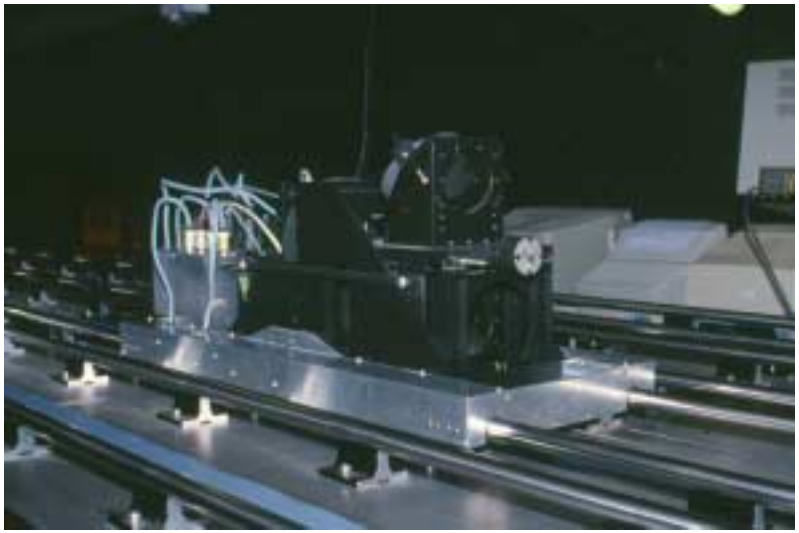


The Instruments need enclosing….

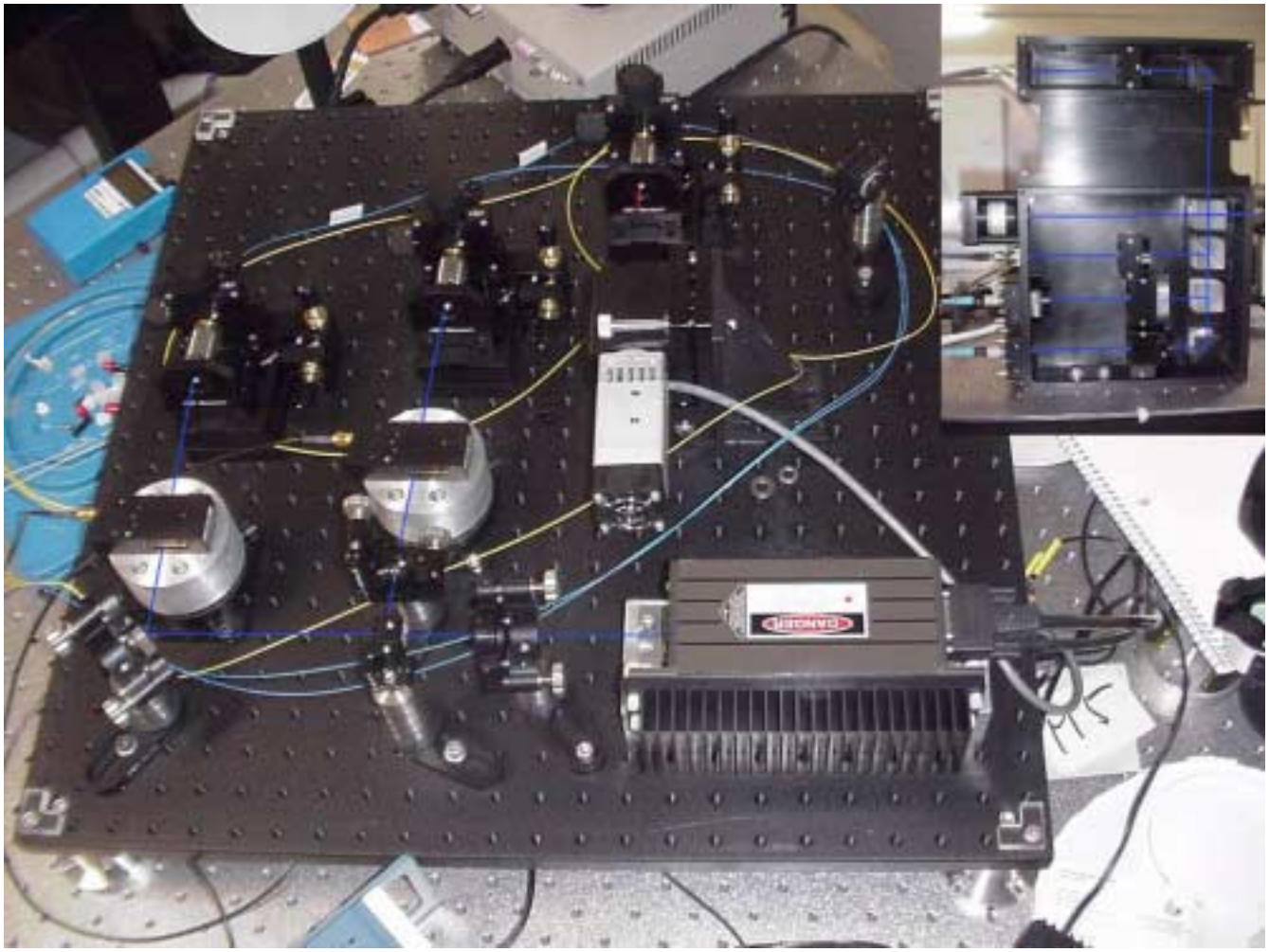
…. and Thermal Stability

Delay Lines sit on Rails….

… and Delay the Light.



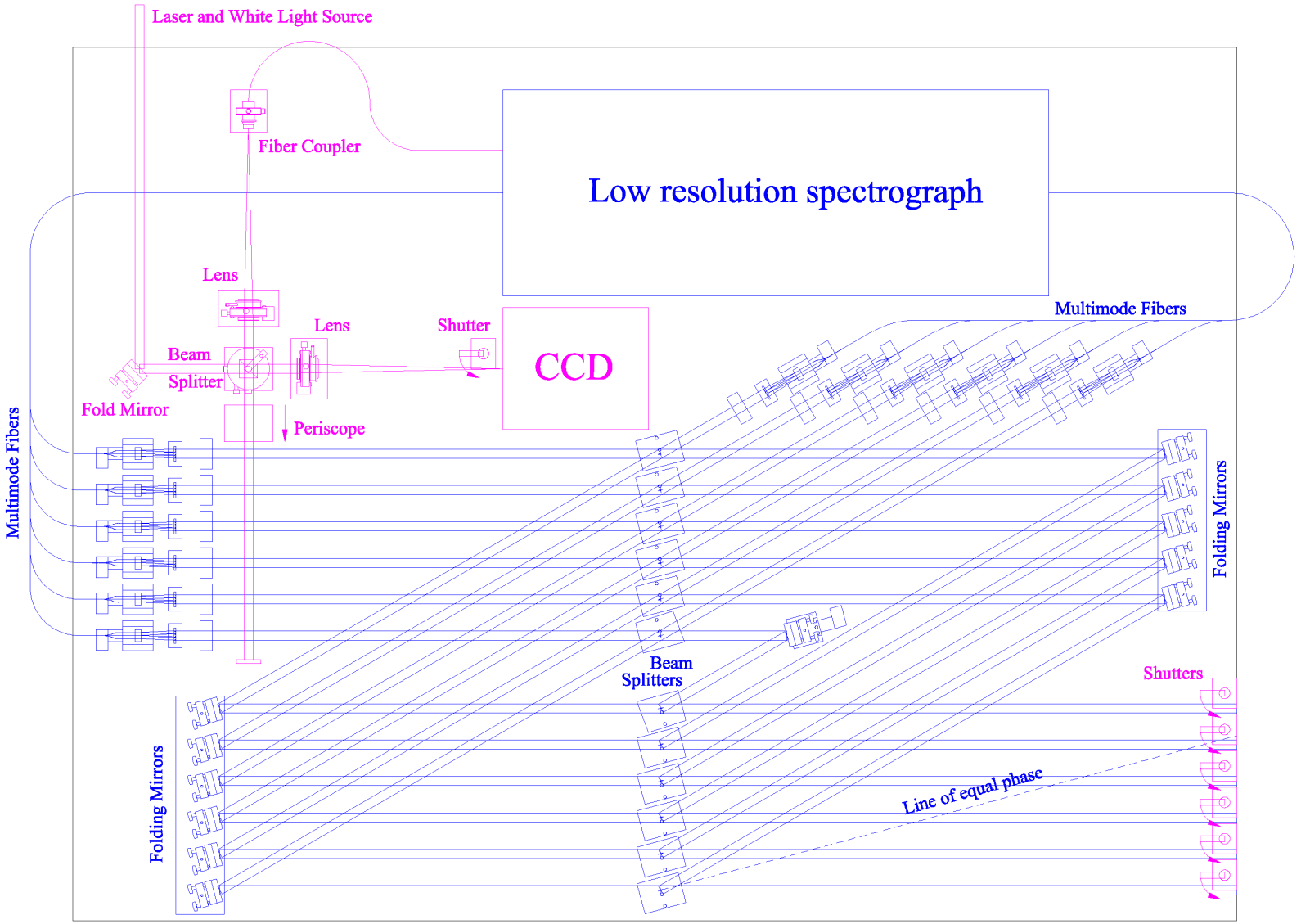
You Need Metrology that Works



What About a Beam Combiner?

- Modulation scheme – temporal or spatial?
- Open air, fiber or a combination?
- How many beams at a time?
- How do you divide the light – gray, color or polarization?
- Are fringe tracking and imaging the same thing?

Interferometry and Stellar Interferometers



Interferometry and Stellar Interferometers

You will Need a lot of Electronics

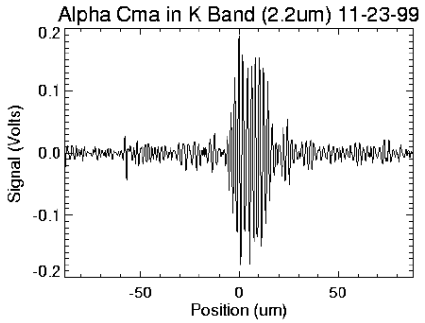
And Don’t Forget the Control System






Both will Need Debugging

If it all works… you party.



Optical Long Baseline Interferometry Newsletter

- **http://huey.jpl.nasa.gov/olbin/**
- **Contains links to all existing and proposed optical/IR interferometer projects.**
- **News**
- **Papers and preprint information**
- **Upcoming meetings**
- **Contact information**
- **Translations of selected papers**
- **List of PhD and Masters theses**
- **Photographs and resources**
- **Job listings**